CLAIMS

1. A process employed to scan a complex surface (202, 302, 402) which is delimited at least in part by a physical barrier (411) and/or that has obstacles (114, 406) ; where the said process includes the following stages:

- (a) a stage for scanning, in a suitable manner, a first zone (106, 206_i, 306_i), of small dimensions and of appropriate shape, of the said complex surface,

• where appropriate, detecting the said physical barrier (411) and/or the said obstacles (114, 406), and

• travelling through successive relative positions,

• and integrating the said relative positions ;

in such a manner that enables an absolute position to be established in the said first zone, enabling us to achieve an exhaustive scan of the said first zone;

where the said process also includes:

- (b) a stage for selecting a second zone (206_{i+1}, 306_{i+1}) of small dimensions and of appropriate shape, of the said complex surface, and for iterating the above stage (a) for this second zone,

- (c) a stage to iterate stage (b) as often as necessary in order to scan the whole of the complex surface.

2. A process according to claim 1, in which the said process also includes:

- (d) a stage for choosing the dimensions and the shape of each zone (106, 206_i, 206_{i+1}, 306_i, 306_{i+1}) so that the error over the course of time, resulting from the integration of a series of relative positions, remains less than a specified threshold.

3. A process according to one of claims 1 or 2 ; in the case where a scan zone contains all or part of an obstacle (114, 406), where the said process also includes the following stages:

- stages for scanning the zone while remaining, as far as possible, within the zone concerned and following all or part of the contours of the obstacle in the zone, and then

- a stage for selecting the next zone by applying travel rules.

4. A process according to any one of claims 1 to 3 ; where the said process also includes:

- a stage for selecting the said second zone (206_{i+1}, 306_{i+1}) by the execution of a random selection process.

5. A process according to any one of claims 1 to 3 ; where the said process also includes:

- a stage for selecting the said second zone (206_{i+1}, 306_{i+1}) by effecting the selection of a contiguous zone ($308_{i;i+1}$) in a predetermined strip (310) progressing in a set direction and then selecting another strip(312), at random for example.

6. A process according to claim 5, where the said process also includes:

- a strip-changing stage (412, 404_5) when (i) a wall (411) or an obstacle (406) of a dimension or size which is large in relation to that of the scanned zone, is detected in the scanned zone and/or (ii) when a strip (404_6) is encountered which has been scanned already.

7. A process according to any one of claims 1 to 6 ; in order to select the said second zone, where the said second process also includes:

- a stage to establish, in a dynamic manner during the scan, a map of the environment which can be used to apply the travel rules in the different zones comprising the complex surface, taking account of the obstacles, and then

- a stage for selecting the second zone according to the said travel rules.

8. A process according to any one of claims 1 to 7 ; with the process for selection of the zone and/or of the strip including a random phase, where the said process also includes:

- a stage to halt the scan after a time which is greater than a set threshold.

9. A process according to any one of claims 1 to 8 ; where the said process also includes a stage to effect a circuit of the contours of the complex surface after completion of the scan.

10. A system (100, 200, 300, 400) employed to scan a complex surface (202, 302, 402) which is delimited at least in part by a physical barrier (411) and/or that has obstacles (114) ; where the said system includes:

- (a) scanning resources (102) that include detection resources (104) used to detect the said physical barrier and/or the said obstacles ;

where the said scanning resources (102) enable us to scan, in a suitable manner, a first zone (206_i, 306_i) of small dimensions and of appropriate shape, of the said complex surface,

• travelling through successive relative positions, and

• integrating the said relative positions in such a manner that we thus get an absolute location in the said first zone, in order to effect an exhaustive scan of the said first zone ;

where the said system also includes:

- (b) selection resources (110, 210) used to select a second zone (206_{i+1}, 306_{i+1}) of small dimensions and of appropriate shape, of the said complex surface, and to iterate the above stage (a) for this second zone,

- (c) iteration resources to iterate stage (b), as often as necessary, so as to scan the whole of the complex surface.

11. A system according to claim 10 ; where the said system also includes:

- (d) computer processing resources (112) to choose the dimensions and the shape of each zone so that the error over the course of time, resulting from integrating the succession of relative positions, remains less than a specified threshold.

12. A system according to one of claims 10 or 11 ; in the case where a scan zone contains all or part of an obstacle, the said system also includes scanning resources (102) to scan the zone while remaining, as far as is possible, within the zone concerned, and following all or part of the contours of the obstacle in the zone, with the said selection resources selecting the next zone by applying travel rules.

13. A system according to any one of claims 10 to 12 ; with the said selection resources (110, 210) selecting the

said second zone (206_{i+1}) by the execution of a random selection process.

14. A system according to any one of claims 10 to 12, where the said selection resources (110, 210) select the said second zone (306_{i+1}) by effecting the selection of a contiguous zone ($308i_{;i+1}$) in a predetermined strip (310) progressing in a set direction and then selecting another strip, at random for example.

15. A system according to claim 14, where the said computer processing resources (112) include computing resources to change strip when (i) a wall or an obstacle of a dimension or size which is large in relation to that of the scanned zone is detected in the scanned zone and/or (ii) a strip is found which has already been scanned.

16. A system according to any one of claims 10 to 15, where the said system includes computer processing resources (112), where the said computer processing resources (112) include computing resources used:

• to establish, in a dynamic manner during the scan, a map of the environment which can be used to apply the travel rules in the different zones comprising the complex surface, taking account of the obstacles ; and then

• to select the second zone according to the said travel rules.

17. A system according to any one of claims 10 to 16 ; where the process for selection of the zone and/or of the strip includes a random phase, where the said system includes computer processing resources to halt the scan after a time which is greater than a set threshold.

18. A system according to any one of claims 10 to 17 ; where the said system includes computer processing resources used to perform a circuit of the contours of the complex surface after completion of the scan.

19. A system according to any one of claims 10 to 18 ; where the said scanning resources are used to calculate, in a dynamic manner, the said map of the complex surface from data supplied by the said detection resources while scanning the said complex surface.

20. A system according to any one of claims 10 to 19 ; where the said detection resources (104) include

an infrared radiation emitter,

an infrared radiation receiver detecting the infrared radiation reflected by the concerned parts of the physical barrier or obstacle ;

where the said computer processing resources (112) are used to gradually vary the power of the infrared radiation emitted by the said emitter up to a power that is sufficient to detect the concerned parts of the physical barrier or of the obstacle, where the said computing resources are used to determine the relative position of the concerned parts of the said physical barrier or of the said obstacle, in relation to the said mobile robot, as a function of the said value of the detected power in such a manner that it is then possible, in a dynamic manner as the robot is moving over the surface:

• to determine the geometrical data (angles and lengths, etc.) characterising the geometry of the obstacles or of the physical barrier, and/or

• to construct a map of the complex surface.

21. Application of the process according to claims 1 to 9 or of the system according to claims 10 to 20 to the implementation of a robot or automatic system for the treatment of flat and/or warped surfaces, of a robot for the treatment of wild or cultivated land, of a vacuum-cleaning robot, of a robotic lawn mower, of a robot employed to wash horizontal or inclined walls, particularly of the glazed or ceiling or roof type, or of a robot for the decontamination of complex contaminated surfaces.